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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 09/739,620 | 12/20/2000 | Noriaki Oda | Q61572 | 4739 |

7590

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EXAMINER

NGUYEN, HA T

ART UNIT

PAPER NUMBER

2812

DATE MAILED: 04/09/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

09/739,620

Applicant(s)

ODA, NORIAKI

Examiner

Ha T. Nguyen

Art Unit

2812

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 03 March 2003.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4,5,7-11 and 25-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4,5,7-9,11,25-29,32 and 33 is/are rejected.
- 7) ☒ Claim(s) 10,31 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on _____ is: a) ☐ approved b) ☐ disapproved by the Examiner.
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892) 4) ☐ Interview Summary (PTO-413) Paper No(s). _____
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948) 5) ☐ Notice of Informal Patent Application (PTO-152)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____. 6) ☐ Other:

DETAILED ACTION

Notice to applicant

1. Applicant's Amendment and Response to the Office Action mailed 12-3-02 has been entered and made of record (Paper No. 16).

Response to Amendment

2. In view of Applicant's arguments and the amendment to the claims, the rejection of claims 10 and 31 under 35 U.S.C. 112 second paragraph, as being indefinite, has been withdrawn.

In view of Applicant's arguments and amendment to the claims, the rejection of claims 10 and 31 under 35 U.S.C. 103, has been withdrawn.

Applicant's arguments with regard to the rejections under 35 U.S.C. 103 have been fully considered, but they are not deemed to be persuasive for at least the following reasons.

Applicant argued that there is no motivation to combine Mizushima (JP 590262) with Farkas et al. (US Patent 6001730, hereinafter "Farkas"). Mizushima use Au conductor 14 and a cover (adhesion) layer 11. Farkas discloses the use Cu conductor with barrier layer 21 which could be a layer of Ta, TaN, TaSiN or a composite thereof. Farkas implies that any of the combination Ta/TaN, TaN/Ta, Ta/TaN/TaSiN...etc would be usable. In the situation where the composite is formed of a Ta layer on a TaN layer, the claimed limitations: first cover of refractory metal nitride and second cover of refractory metal are satisfied. Besides, it is well known in the art that a barrier layer of refractory metal nitride and refractory metal including TaN/Ta composite is commonly used (see Lin et al. (USPN 6342448), Huang (USPN 6156648), and Yamaha et al. (USPN 6146998). Cu is cheaper than Au, using Cu to replace Au in layer 11 and Farkas' composite layer 21 replacing layer 11 in Mizushima would produce reliable device at a lower cost. The expectation of some advantage is the strongest rationale for combining references (MPEP 2144).

Therefore the combined teaching of Mizushima with cited references does make obvious the claimed invention recites in claims 1, 2, 4, 5, 7-9, 11, 25-29, 32, and 33.

Applicant is referred to the modified statement of the ground of rejection given below.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103® and potential 35 U.S.C. 102(f) or (g) prior art under 35 U.S.C. 103(a).

4. Claims 1, 2, 4, 5, 7-9, 25-30, and 33 are rejected under 35 U.S.C. 102(b) as being unpatentable over Mizushima (JP 590262) in view of Farkas et al. (US Patent 6001730, hereinafter "Farkas").

[Claims 1, 2, 4, 5, 25-27, and 33] Referring to Figs. 1A-1D and related text, Mizushima discloses a semiconductor device comprising: a substrate 1 having a surface; a dielectric 7 formed over the surface of the substrate; and a wiring line buried in the dielectric layer; the wiring line including a conductor 14 and first cover layer 11 covering an outer surface of the conductor; the first cover layer being made of refractory metal containing compound (see constitution); wherein the first cover layer entirely covers the outer surface of the conductor, note that the examiner interprets the outer surface of the conductor to be the surface surrounding the conductor; a third cover layer 13 provided between the conductor and the first cover layer; wherein the second cover layer covers entirely or partially the outer surface of the conductor ; wherein the third cover layer covers entirely or partially the outer surface of the conductor, the third cover layer being made of dielectric. But it does not disclose expressly that the conductor is of Cu-based, the first cover layer is of refractory metal nitride, a second cover layer of refractory

metal is provided between the conductor and the first cover layer. However, the missing limitations are well known in the art because Farkas discloses the use of Cu conductor 28 and a diffusion layer for Cu could be a combination of layers of Ta, TaN, TaSiN...etc (See col. 4, lines 48-58) when Farkas combination of layers, for example TaN and Ta, is used as diffusion barrier in place of conductive film designated as numeral 11 in Mizushima, all the limitations of the claims are met. A person of ordinary skill is motivated to modify Mizushima with Farkas to obtain reliable device at low cost with better protection against diffusion.

[Claims 7-9 and 28-30] Farkas also discloses wherein the dielectric formed over the surface of the substrate is made of inorganic material and has a relative dielectric constant ranging from 1.6 to 9; of organic material and has a relative dielectric constant ranging from 1.6 to 3; and whereing the wiring line has a damascene structure (see Fig. 4 and col. 4, lines 12-47).

Therefore, it would have been obvious to combine Mizushima with Farkas to obtain the invention as specified in claims 1, 2, 4, 5, 7-9, 25-30, and 33.

5. Claims 11 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Mizushima in view of Farkas, as applied to claims 1, 2, 4, 5, 7-9, 25-30, and 33 above, and further in view of Nogami et al. (U.S. Patent 6214731, hereinafter "Nogami").

The combined teaching of Mizushima and Farkas discloses substantially the limitations of claims 11 and 32, as shown above.

But it does not disclose expressly a via hole of tapered shape with the claimed slope.

However, the missing limitation is well known in the art because Nogami discloses this feature (See fig. 1A).

A person of ordinary skill is motivated to modify Mizushima and Farkas with Nogami to obtain better filling of the contact hole.

Therefore, it would have been obvious to combine Mizushima and Farkas with Nogami to obtain the invention as specified in claims 11 and 32.

Allowable Subject Matter

6. Claims 10 and 31 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

Claims 10 and 31 recites "wherein the dielectric in which the wiring line is buried has a composite structure comprising a first dielectric layer, an etch stop layer formed on the first dielectric layer, and a second dielectric layer formed on the etch stop layer; and wherein a bottom surface of the first cover layer is approximately in a same level as an upper surface of the first dielectric layer; and wherein a top surface of the first cover layer is approximately in a same level as an upper surface of the second dielectric layer".

These features in combination with the other elements of the claims are neither disclosed nor suggested by the prior art of record.

Conclusion


7. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

8. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ha Nguyen whose telephone number is (703)308-2706. The examiner can normally be reached on Monday-Friday from 8:30AM to 6:00PM, except the first Friday of each bi-week.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, John Niebling, can be reached on (703) 308-3325. The fax phone number for this Group is (703) 308-7722.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Group receptionist whose telephone number is (703) 308-0956.


Ha Nguyen
Primary Examiner

Application/Control Number: 09/739,620

Art Unit: 2812

Page 6

4- 3- 03